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Abstract

CRITICALITY ALARMS - RECENT PROGRESS IN BURST SLUG DETECTION

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A - THE DETECTION OF CRITICALITY ACCIDENTS IN THE COMMISSARIAT A L'ENERGIE ATOMIQUE

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In all installations where fissionable materials are handled in quantities virtually greater than the critical mass, there exists permanent risk of accidental nuclear excursion entailing a serious irradiation hazard to the personnel, in spite of all the precautions that might be taken. Immediate detection followed by rapid evacuation greatly limits the risks of irradiation due to the fission products or to the sustained nuclear reaction. Tne necessity for a suitable equipment for the detection of accidents of criticality is imposed by the fact that the physical phenomena accompanying a nuclear excursion are insufficient to follow the alarm, and may lead to confusion.

Taking into account the accidents which have occurred and the role expected from a detector, we choose a dose integration device for the detecting probe proper, and a system based on the coincidence of several informations to trigger the alarm. At the demand of the Commission des Masses Critiques, the minimal physical and electronical features required to obtain a very reliable system with minimal risk of false alarm has been established.

These features are described in some detail.

The equipment constructed at the Commissariat à l'Energie Atomique on the basis of these recommendations has been tested systematically under ac-

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tual conditions of nuclear excursions at the Health Physics Research Reactor of the National Laboratory at Oak Ridge. These tests have served to determine two types of detection probes which will be described : a photomultiplier and a semi-conductor probe.

Finally the authors present an example of a complete unit for the detection of criticality accidents in an installation for the processing of fissile material.

B - THE EVOLUTION OF THE INSTALLATIONS FOR BURST SLUG DETECTION (B.S.D.) IN FRENCH REACTORS.

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The main part of the effort in the field of the Burst Slug Detection has been orientated on the large gas-cooled reactors where the problem of bursts slugs is associated with the economics of the plant.

The techniques developped during this programme can be subsequently adapted to easily solve problems of detection in other types of reactor.

The main characteristics of the evolution of the various installations constructed or under construction is reflected in the continuous progress towards greater automation and the use of detectors working under higher and higher temperatures and pressures.

Succeeding to the reactor G3 whose BSD installation was already highly automatic, the EDF reactors at CHINON use digital computers especially meant for BSD data processing. In the planned reactor EL 4, the BSD measurements will be processed with all the other control measurements in a centralized computer unit.

The progressive pressure increase of the cooling gas (15 bars in G3, 25 bars in the Chinon reactors, 60 bars in EL 4) has required the development of electric precipitations able to separate and measure the fission products in the carbonic gas at temperatures reaching 300°C and under pressures as high as 60 bars.

In spite of the severe conditions of utilisation, the various devices developed offer all the guarantees of safety and long life expectancy required for their use on BSD installations.